1445 Trifolium globoſum repens C. B. P. 329
1446 Tordylium maximum Inſt. R. H. 320.
1447 Tragoſelinum maximum Auſtriacum foliis magis inciſis Boer.
1448 Valeriana Luſitanica latifolia annua laciniata Tourn. 132.
1449 Verbena tenuifolia C. B.
1450 Urtica racemifera maxima Sinarum foliis ſubtus argentea lanugine villoſis. Pluk. Almag. 212.

XXV. *Some Obſervations upon the Sex of Flowers by* W. Watſon, *F. R. S. occaſioned by a Letter upon the ſame Subject, by Mr.* Mylius *of* Berlin.

Extract of Mr. Mylius's *Letter to Mr.* Watſon, *dated at* Berlin, Feb. 20, 1750-51.

Read May 2. 1751. "THE ſex of plants is very well confirmed by an experiment, "that has been made here on the *palma major* "*foliis flabelliformibus.* There is a great tree of this "kind in the garden of the royal academy. It has "flower'd and bore fruit theſe thirty years; but the "fruit never ripen'd; and when planted, it did not "vegetate. The palm-tree, as you know, is a *planta* "*dioecia*; that is, one of thoſe, in which the male "and female parts of generation are upon different "plants. We having therefore no male plant, the

" flowers of our female were never impregnated by " the *farina* of the male. There is a male plant of " this kind in a garden at Leipſic, twenty German " miles from Berlin. We procured from thence in " April 1749 a branch of male flowers, and ſuſ- " pended it over our female ones; and our experi- " ment ſucceeded ſo well, that our palm-tree pro- " duced more than an hundred perfectly ripe fruit; " from which we have already eleven young palm- " trees. This experiment was repeated laſt year, " and our palm-tree bore above two thouſand ripe " fruit. As I do not remember a like experiment, " I thought convenient to mention it to you; and, " if you think proper, be pleaſed to communicate " it to the Royal Society."

In purſuance of my correſpondent's deſire, I take the liberty of laying this account before you, which I think very curious; not on account of its novelty, or of its confirming the ſex of plants, which is now ſufficiently eſtabliſhed; but on account of the male and female palm-tree's flouriſhing ſo completely, even under all poſſible advantages, in ſuch high latitudes as thoſe of Leipſic and Berlin.

The impregnation of the female palm-tree by the male has been known in the moſt antient times. Herodotus *, whom Cicero calls the father of hiſtory, when

* Herodot. Κλειω.

Τά τε ἄλλα ϰ) φοινίϰων τὰς ἔρσενας Ἕλληνες ϰαλέουσι, τοῦλαν τὸν ϰαρπὸν περιδέουσι τῇσι βαλανηφόροισι τῶν φοινίϰων, ἵνα πεπαίνηται σφὶ ἡ τὴν βάλανον ἐσδύνων, ϰ) μὴ ἀποῤῥέῃ ὁ ϰαρπὸς ὁ τῆς φοίνιϰος· ἦεν γὰρ δὴ ϰαὶ φέρεσι ἐν τῷ ϰαρπῷ οἱ ἔρσενες, ϰαθάπερ δὴ ϰαὶ ὀλυνθοι.

when ſpeaking of the palm-tree, ſays, " that the " Greeks call ſome of theſe trees male, the fruit of " which they bind to the other kind, which bears " dates; that the ſmall flies, wherewith the male " abounds, may aſſiſt in ripening the fruit; for, ſays " this author, the male palm-tree produces in its " fruit ſmall flies, juſt as the fig-tree does." The very remote age, in which Herodotus wrote, ſufficiently apologizes for his believing, that what was really brought about by the *farina fœcundans* of the male flower, was to be attributed to the inſects frequently found therein, and which perhaps very often do carry this *farina* from the male to the female. They had ſeen the effects of caprification in fig-trees by theſe inſects, and were miſled by the analogy. I have here tranſlated them ſmall flies, but they had a particular appellation given them by Herodotus, Ariſtotle *, and Theophraſtus, who call them ψήν. Pliny, in his hiſtory, when treating of caprification, which is almoſt a tranſlation from Theophraſtus, calls them *culices*, Linnæus *ichneumones*, and Tournefort *moucherons*.

Theophraſtus §, the moſt early writer of plants, except Ariſtotle, that has been handed down to us, in his account of the palm-tree gives us the very proceſs mentioned by our correſpondent. " They " bring together (ſays this author) the males and " the females, which cauſes the fruit to continue, " and ripen upon the trees. Some, from the ſimili-

* Ariſtoteles περὶ ζώων. Οἱ δὲ ἐρινοὶ - - - - ἔχουσι σῦς καλουμένους ψῆνας.

§ Theoph. περὶ φυτῶν. Κεφ. θ.

" tude of this to what happens in fig-trees, call it " caprification; and it is performed in the following " manner: While the male plant is in flower, they " cut off a branch of theſe flowers, and ſcatter the " duſt and down therein upon the flowers of the " female plant. By theſe means," he goes on, " the " female does not caſt her fruit, but preſerves them " to maturity." Pliny* alſo mentions the like proceſs.

Among more modern authors, Proſper Alpinus ‡ gives us at large the manner of the impregnation of the female palm-tree by the male, for the purpoſes before-mentioned. We have alſo copious accounts of the ſame proceſs by Tournefort §, Kæmpfer ‖, and Ludwig **. As Kæmpfer was an eye-witneſs, his account of this matter is moſt to be depended upon. He ſays, " Plena res digniſſimaque admirationis eſt " modus palmas fæmininas fœcundandi. Habet id " tot popularium, Perſidis, Arabiæ, Ægypti, nutrix " inter plantas ſingulare, ut animalium exemplo, " mari ſtato tempore miſcenda, atque ſinguli ejus " uteri, quaſi conjugali coitu, impregnandi ſint; ſe- " cus omnia ſua, quæ in lucem prodiderat, fructuum " rudimenta, indeclinabili abortu dimiſſura. Palmi- " colis itaque incumbit, ut impregnandis arboribus " quotannis impendant operam, ſiquidem in ſe re- " dundare annonam cupiunt. Modus procedendi " hic

* Plinii Hiſt. Nat. lib. xiii. cap. iv.
‡ Alpin. de plant. Ægypt. p. 16.
§ Iſagog. inſtit. rei herbar. p. 69.
‖ Amœn. exot. p. 706.
** Diſſert. de ſexu plant. p. 29.

" hie eſt: ſpaltæ maſculæ incluſo tumentes flore, et
" ad thalami conſortium maturo, ſub finem Februarii
" ex arboris faſtigio extrahuntur; quibus in longum
" diſſectis eximuntur ſpadices, floſculis nondum oſ-
" citantibus, ſed in unam maſſam compactis con-
" ferti. Hos protinus in ſurculos ſive bacillos, ſpa-
" dicibus fæmininis inſerendos divellunt. Bacillos
" alii amant recentes, atque illico inſinuare ſpadici-
" bus, ſi qui jam lucem nacti ſunt; alii eos prius
" exſiccant, et in Martium uſque menſem cuſtodiunt,
" quo hiantibus uteris ad unum omnibus inſitionem
" uno actu et opera inſtituant."

As I am now upon the ſex of plants, I cannot but obſerve, that although the ancients diſtinguiſhed rightly, in determining the true ſexes of the palm-tree, it is the only plant, in which they have not erred. Though they called plants of the ſame *genus*, or of others very nearly related thereto, male and female, it was upon an imaginary, a falſe principle; and that uſually taken from their ſize, the difference of their leaves, or the figure of their fruit; and what therefore they have denominated male and female, muſt not with the modern exactneſs be rigorouſly conſidered as ſuch. Thus Ariſtotle *, after having taken notice that there was the diſtinction of male and female obſervable in plants, ſays, " that the male § plant
" is more rough and ſtrong, the female more weak
" and fruitful." And Theophraſtus ‖, when ſpeaking

* De plant. lib. i. cap. 2.
ἐνεῖσθαι ἐν τοῖς φυτοῖς ὅτι ἔχει τὰ φυτὰ γένος ἄῤῥεν καὶ θῆλυ.
§ Ariſtot. ibid.
‖ Plantar. hiſtor. lib. iii. cap. 10.

ing of the male and female pine-tree, ſays, " that " the Macedonians have trees nearly related to pines, " of which the male is of ſhorter growth, and has " harder leaves; that the female is taller, and has " its leaves ſofter, and more fleſhy." He ſays, upon his own authority, " that the wood of the male pine " is hard, that of the female more ſoft." Pliny * alſo in his hiſtory gives a like reaſon for his diſtinguiſhing the ſex of the pine: he ſays farther §, in another part of the valuable monument he has left us, " that the moſt expert naturaliſts aſſert, that every " tree, and every herb, which the earth produces, " hath both ſexes:" but this is to be underſtood in the manner I juſt now mentioned; and ſo likewiſe is the diſtinction among the more modern botaniſts in their denominations of ſeveral plants, ſuch as *Veronica*, *Eupatorium*, *Anagallis*, *Tilia*, *Pæonia*, *Balſamita*, *Filix*, *Quercus*, *Orchis*, *Laureola*, *Abrotanum*, *Cornus*, *Polygonum*, *Equiſetum*, *Mandragora*, and others, which are termed imaginarily male and female; as the diſcovery of the real ſex of plants was reſerved for the accuracy of the preſent age.

Beſides the before-mention'd erroneous principle, from which the antients, as well as ſome more modern authors, determined the ſex of plants, there is yet another, which I think right to mention in this place; and that is, a denomination of plants from their ſex, which is abſolutely falſe: and in order to elucidate this poſition, and to ſhew at the ſame time wherein

* Lib. xvi. cap. 10.
§ Lib. xiii. cap. 4.

wherein the ſex of plants does really conſiſt, I muſt beg leave to premiſe, that it is in the flowers of vegetables only, that the parts ſubſervient to generation are produced. Simple flowers (I uſe this term in oppoſition to the compound flowers of the botaniſts) are either male, female, or hermaphrodite. By male flowers, I would be underſtood to mean thoſe, which are poſſeſſed only of thoſe organs of generation, analogous to the male parts of animals; and theſe are, what former botaniſts have denominated *ſtamina* and *apices*, but are nam'd more properly by Linnæus ſince, *filamentum* and *anthera*. The female flower is only endowed with parts like thoſe, which perform the office of generation in females; and theſe are the *piſtillum* and its appertenances, which by Linnæus, with his accuſtomed accuracy, are divided into three parts; *viz.* the *germen*, *ſtylus*, and *ſtigma*. The hermaphrodite flower, which conſtitutes the great bulk of the vegetable creation, is poſſeſſed of all theſe parts in itſelf, and is itſelf thereby capable of propagating its ſpecies without any foreign aſſiſtance; which, by many inconteſtable experiments it has been found neither the male nor female flower ſimply is able to do.

Much the greater number of plants, as I have juſt hinted, have hermaphrodite flowers; but there are ſome, which have both the male and female flowers growing from the ſame root. Such are *Mays* or Indian corn, nettles, box, elm, birch, oak, walnut, beech, hazel, hornbeam, the plane-tree, pine, fir, cypreſs, cedar, the larch-tree, melons, cucumers, gourds, and ſeveral others. In many of theſe, though the male and female flowers are at conſiderable diſtances,

diſtances, the *farina fœcundans*, which Providence, on account of its being liable to be ſpoiled by rain, or diſſipated by winds, has provided in great abundance, is conveyed to the female by means of the atmoſphere. It is this claſs of vegetables, and the following, the quantity of the produce of which is much more precarious than thoſe plants, which have hermaphrodite flowers; as the impregnation of theſe laſt may be performed within their own calyx; whereas the former muſt neceſſarily commit their *farina* to the circumambient air. It is for this reaſon, that if during the time of the flowering of theſe plants, the weather is either very wet or ſtormy, their produce of fruit will be very inconſiderable, from the ſpoiling or haſty diſſipation of the male *farina*. Thus independent of froſts, the fruit of the nut and filberd-tree will be moſt numerous in thoſe years, in which the months of January and February are the leaſt ſtormy and wet; as at that time their flowers are produced. For the ſame reaſons, a ſtormy or wet May deſtroys the cheſnuts; and the ſame weather in July prodigiouſly leſſens the crop of *Mays* or Indian corn, as its ſpikes of male flowers ſtand lofty, and at a conſiderable diſtance from the female. In like manner a judgment may be formed of the reſt of theſe.

Some of the more ſkilful modern gardeners put in practice, with regard to melons and cucumers, the very method mention'd by Theophraſtus 2000 years ago, in regard to the palm-tree. As theſe plants, early in the ſeaſon, are in this climate confined to frames and glaſſes, the air, in which they grow, is more ſtagnant than the open air, whereby the diſtribution

of

of the *farina fœcundans*, ſo neceſſary towards the production of the fruit for the propagation of the ſpecies, is much hindered; to obviate which, they collect the male flowers when fully blown, and preſenting them to the female ones, by a ſtroke of the finger they ſcatter the *farina fœcundans* therein, and this prevents the falling of the fruit immaturely.

Beſides the vegetables before-mentioned, which bear both male and female flowers upon the ſame root, there are others, which produce thoſe neceſſary organs upon different roots. In the number of theſe are the palm-tree (the more particular ſubject of this paper) hops, the willow-tree, miſletoe, ſpinach, hemp, poplar, French and dog's mercury, the yew-tree, juniper, and ſeveral others. Among theſe the *Valiſneria* of Linnæus, as to the manner, in which its male flower impregnates the female, is one of the moſt ſingular prodigies in nature. The manner of this operation is figured by Micheli, in his *Nova plantarum genera*, and deſcribed by Linnæus, in the *Hortus Cliffortianus*. As that elaborate and expenſive work is in very few hands, in ſuch only as owe it to the munificence of Mr. Clifford of Amſterdam, of which number I with pleaſure acknowlege myſelf one, I will here lay before you a ſhort account thereof:

The *Valiſneria* grows in rivulets, ditches, and ponds, in many parts of Europe. The male plant, which is continually covered with water, has a ſhort ſtalk, upon the top of which its flowers are produced. As this top never reaches the ſurface of the water, the flowers are thrown off from it, and come unopened to the ſurface of the water; where, as

ſoon as they arrive, by the action of the air, they expand themſelves, and ſwim round the female flowers, which are blown at the ſame time. Theſe laſt have a long ſpiral foot-ſtalk, by which they attain the ſurface of the water, and remaining there in flower a few days, are impregnated by the male flowers detached from the ſtalk at the bottom. This operation ſeems to be thus directed, as the *farina fœcundans* could not exert its effects in ſo denſe a medium as water; and we find, that even the hermaphrodite flowers of water-plants, ſuch as thoſe of *potamogiton*, *ranunculus aquaticus*, *hottonia*, and *nymphœa*, theſe, I ſay, never expand themſelves, until they reach the ſurface of the water.

But to return: it was not poſſible for me, without premiſing theſe things, to make evident what I juſt now mention'd, in relation to the falſely denominating the ſexes of plants; as it is to this laſt claſs that the wrong application has been made by botanical writers. This error ſeems to have been firſt introduced ſo early as by Dioſcorides, and has been continued through a great variety of writers even to our own time. It is moſt certain, that thoſe plants, which produce the ſeed, ought to be conſidered as females; but it happens that in the French and dog's mercury, the ſeeds are produced in the female plants by pairs; and theſe are contained in a capſule, which was thought to reſemble the *ſcrotum* of animals; and from this teſticulated appearance they called theſe plants males, and the others females.

Thus, for example, Dioſcorides *, when treating of *mercurialis*, or what we here call French mercury, ſays, that " the ſeed of the female is produced in " bunches, and is copious; that of the male grows " near the leaves; that it is ſmall and round, and is " diſpoſed in pairs like teſticles." Dodonæus, Lobel, Dalechamp, John and Caſpar Bauhin, Morriſon, Tournefort, and Boerhaave, in their ſeveral works, have in this followed Dioſcorides, and have denominated the ſeed-bearing plant of this kind, the male; and the other, the female. Fuchſius and John Bauhin likewiſe call the *cynocrambe* or dog's mercury, which bears fruit, the male; and the ſpiked one with male flowers only, the female. This miſtake is obſervable in hemp §, hops, and ſpinach.

We obſerve, that the operations of nature are carried on moſt uſually by certain general laws, from which however ſhe ſometimes deviates. Thus almoſt all plants have either hermaphrodite flowers, or male and female flowers growing from the ſame root, or male and female flowers from different roots: but there are a few of another claſs, which from the ſame root furniſh either male and hermaphrodite flowers, or female and hermaphrodite flowers. Of this kind are the mulberry-tree, the *muſa* or plantain-tree, white hellebore, pellitory, arrach, the aſh-tree, and a few others. But of this claſs the *empetrum*

* Dioſcorid. lib. iv. cap. 9. edit. Saracen.
Λινόζωστς οἱ δὲ παρθένιον, οἱ δὲ Ἑρμῆ Σῆλάνιον καλοῦσι . . . . . τὸν δὲ καρπὸν ἡ μὲν θήλεια βοτρυοειδῆ καὶ πολύν· ὁ δὲ ἄῤῥην πρὸς τοῖς πέλαλοις μικρὸν, στρογγύλον, ὥσπερ ὀρχίδια καὶ δύο περικείμενα . . . .

§ Matthiol. in Dioſcorid. p. 663. ſemen tantum in mari gignitur.

or berry-bearing heath is the moſt extraordinary; as of this are found ſome plants with male flowers only. others with both male and female flowers ſeparately, and ſtill others with hermaphrodite flowers.

What Pere Labat mentions in his *Voyage à l'Afrique occidentale* ſhould likewiſe be taken notice of here. This author, after having laid down the different methods of impregnating the female palm-tree by the male, ſays, that this proceſs is not abſolutely neceſſary for the production of dates; for being at Martinico, he there ſaw growing by an old convent near the place, where they anchored, a palm-tree bearing dates, although the only one of its kind, which was thereabouts. Whether it was male or female, he did not pretend to determine, but was certain, that there then was none, nor had been one, within two leagues of the place where it grew. He doubts indeed, whether or no this tree bearing fruit did not proceed from the *farina fœcundans* of the male cocoa tree, which is a ſpecies of palm, and which grew in abundance near the tree that bore dates: but he obſerves, that the ſtones of theſe dates did not vegetate, and that thoſe, who were deſirous of propagating date-trees, were obliged to plant the Barbary dates; as he believed the others had not the germ proper to produce the tree. From this account it is very obvious, that the palm-tree here mentioned was a female, in which though the fruit ripened, it was in ſuch a ſtate of imperfection, as not to be able to propagate its ſpecies. In this manner we have eggs furniſhed us by hens, even without a cock; but theſe eggs produce no chickens. What this father ſays of the female palm-tree's bearing fruit without

without the aſſiſtance of the male, our very ingenious and worthy brother Mr. Miller aſſures me, has been fully confirmed to him by ſeveral perſons: and John Bauhin *, an author of great credit, deſcribes and figures the whole fructification of a palm-tree, which himſelf ſaw growing at Montpelier, and which not only produced branches of male flowers, but alſo female ones bearing dates. Mr. Ray many years after tells us in his hiſtory of plants §, that he himſelf at Montpelier ſaw this very remarkable tree mentioned by John Bauhin.

This variety in the fructification of the palm-tree, ſingular as it may ſeem, has been likewiſe obſerved in ſome few others. The learned Jungius, in his *Doxoſcopia* ‖, mentioning that claſs of trees, which are male and female in different parts of the ſame tree, ſays, " that trees of this kind, when they " have for many years produced flowers without " fruit, afterwards produce fruit without flowers. " This, he thinks, ſhould be further inquired into." This, ſince Jungius's time, has been done, and it has been found that ſometimes ſome of the trees of this claſs are wholly male, while young; but as they advance in age, they have flowers of both ſexes, and afterwards become intirely female. This fact Mr. Miller has frequently himſelf obſerved in the mulberry tree; and the Chevalier Rathgeb, at preſent the emperor's miniſter at Venice,

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* Hiſt plant. com. i. p. 351.

§ Raii hiſt. plant. com. i. p. 1354.

‖ [illegible]. p. 145. *Uni aliquo annos flores tulerunt ſine fructu, deinde fructus ferre ſine flore, quod amplius obſervandum.*

nice, a gentleman excellently well verſed in whatever relates to vegetation, has obſerved, that a large *lentiſcus*, or maſtich-tree, near his garden, had for thirty years produced only male flowers, but that for three years paſt it had produced plenty of fruit.

The foundation of the diſcovery of the real ſex of plants, which is of no leſs importance in natural hiſtory, than that of the circulation of the blood in the animal œconomy, was laid by the members of this learned Society; although much of the honour due to them is attributed by foreigners to the late ingenious Monſieur Vaillant of Paris: and this may have ariſen from our language not being generally underſtood upon the continent. Sir Thomas Millington *, ſometime Sedleian lecturer of natural philoſophy at Oxford, as we ſee by our worthy member Dr. Grew's anatomy of plants §, ſeems firſt to have aſſigned a more noble purpoſe to the *ſtamina* and *apices* of flowers, than that which had been attributed thereto by preceding writers, and by Monſieur Tournefort afterwards; *viz.* that of ſecreting ſome excrementitious juices, which were ſuppoſed hurtful to the embryo's of the fruit. Sir Thomas conjectured, and rightly, "that the *ſtamina* "and *apices* ſerved as the male for the generation "of ſeed." This hint, which was afterwards adopted by our learned brother Mr. Ray, in the preface to

* Dr. Grew calls Sir Thomas Millington Savilian profeſſor, which is a miſtake. See *Wood's Faſti. Oxon.* vol. ii. col. 126. 2d edit.

§ Page 171.

to his *Sylloge ſtirpium exterarum*, Dr. Grew carried farther, as we find by his works; and it was followed by ‖ Rodolphus Jacobus Camerarius, profeſſor at Tubingen: but our very induſtrious and ſagacious member Mr. Morland * purſued long after this inquiry ſtill much higher, as we ſee by his excellent memoir publiſhed in the *Philoſophical Tranſactions*, to which I muſt beg leave to refer you. After theſe, Meſſieurs Vaillant and Geoffroy illuſtrated and ſtrengthened theſe diſcoveries by very curious and well adapted experiments; ſo that at preſent nothing ſeems wanting for the confirmation of the truth of this doctrine.

So much for the diſcovery of the ſex of plants in general, upon which profeſſor Linnæus of Upſal has founded his ſyſtem of botany, at preſent ſo much and ſo well received Whoever therefore would conſider minutely the ſtructure of flowers and the almoſt infinite variety of the number and diſpoſition of their parts, may conſult Linnæus's *Philoſophia botanica* lately publiſhed, where this ſubject is treated in a very copious and inſtructive manner.

‖ Vide epiſtol. de ſexu plant. Tubing 1694.
* Philoſoph. Tranſ. numb. 287.